19 FEDERAL REPUBLIC OF GERMANY
GERMAN PATENT OFFICE

12 **Offenlegungsschrift***

10 **DE 43 13 284 A1**

21 File number: P43 13 284.7
22 Filing date: 4-23-93
43 Date laid open for public inspection: 10-27-94
51 Int. Cl.[5]:
H 01 J 37/32
C 23 C 14/50
//HO1L21/205.31/18

---

71 Applicant:
Leybold AG, 63450, Hanau, Germany
72 Inventor(s):
Bräuer, Gunter, Dr., 6483 Freigericht, Germany;
Moses, Gerhard, 6450 Hanau, Germany,
Teves, Heinz, Dr., 6466 Gründau, Germany

56 Publications to be taken into account for determination of patentability:

DE	33 10 797 A1
DE	33 09 079 A1
DE	33 00 097 A1
US	49 51 602
US	45 93 644

Patents Abstracts of Japan: 62-192580 A. C-475, Feb. 12, 1988, Vol. 12, N°. 47;
62-202078 A. C-477, Feb. 19, 1988, Vol. 12, N°. 56.

*) Offenlegungsschrift = Laid open print, published patent application (specification examined only as to obvious defects but not as to patentability

---

54 Split sluice for bringing in or bringing out substrates from one processing chamber into an adjacent processing chamber

57 In the case of a split sluice for bringing in or bringing out substrates from one processing chamber into an adjacent processing chamber (3, 4), in particular for a pass-through vacuum-coating installation, with a split passage opening (14) for the substrates (15, 15'...) provided in the wall (5) separating the spaces from one another, the separating wall (5), in the region of the wall parts (16, 17) delimiting the split passage opening (14) is provided with at least two diametrically opposed and parallel grooves, openings or channels (18, 19) extending in a plane parallel to the plane of the separating wall (5), which communicate with connectors (20, 21) via which a blocking gas flows in, which from there fills the entire space delimited by the opening (14), and from there further flows out into the adjacent chambers (3, 4) connected to vacuum pumps (22, 23).

Description

The invention concerns a split sluice for bringing in or bringing out substrates from one processing chamber into an adjacent processing chamber or from atmospheric space into a chamber filled with process gas and vice-versa, in particular for a pass-through vacuum-coating installation, with a split passage opening for the substrates provided in the wall separating the spaces from one another.

Known is a process for coating belts in a vacuum chamber using an endless conveyor belt (DOS 27 47 061) that accompanies the belt to be coated on the way from a take-off roller to a take-up roller, at least over the path through a sluicing arrangement of the vacuum chamber, whereby the belt to be coated is held slippage-free adjacent to both the take-up and take-off ends of the conveyor belt, whereby the belt to be coated is raised up from the conveyor belt over a limited path length and is coated on the side facing the conveyor belt. In this case, the sluicing arrangement consists of a plurality of slit diaphragms parallel to one another, whereby each individual chamber separated by the slit diaphragms is connected, in each case, with the suction connecting piece of a vacuum pump, and whereby the layout of the individual pump groups is such that the pressures from the inlet of the substrate into the first sluicing chamber decrease going toward the process chambers.

Further known (EP 0 106 521) is a process for depositing semiconductor material through means of a glow discharge inside a deposition contrivance with at least a first and a second deposition chamber that are connected together via a gas passage in order to obtain flushing (cleaning) gas from a flushing gas conduit, whereby each of the chambers contains a cathode and an evacuation conduit, whereby in the process a substrate is moved through the gas passage from one of the deposition chambers to the other deposition chamber, process gases are let into plasma regions adjacent to the cathodes, the gases are excited such that they dissociate in the plasma regions into the type of deposits that are deposited on a

surface of the substrate, whereby the process gas introduced into the first chamber displays doping process gas, and the process gas introduced into the second chamber displays intrinsic conduction process gas, whereby unused process gas is drawn off from the plasma regions through the evacuation outlets, and flushing gas is applied to the gas outlet in order to prevent contamination of the process gases among themselves in adjoining deposition chambers, whereby an adequate volume flowthrough rate of flushing gas is directed into the flushing gas channel lying toward the side of the second chamber of the gas outlet, such that a laminar stream of flushing gas, essentially flowing in a direction through the gas passthrough of the second deposition chamber to a first deposition chamber, will be achieved over the surface of the substrate on which has been deposited a layer of semiconductor material, and concerning essentially the diffusion of the doping process gas from the first chamber to the second chamber a stream of flushing gas is prevented from entering the second chamber, so that unused process gas and the non-deposited type of deposit in the second chamber are limited to the vicinity of the cathode and the evacuation outlet.

Often used to produce multi-layer systems for data storage, displays, solar cells, etc., are flowthrough systems in which the essentially two-dimensional substrates are secured on pallets that pass by the various coating stations one after the other. In the case of the coating process, we are dealing principally with non-reactive and reactive atomization (spraying) and CvD (Chemical vapor deposition) processes.

Since the individual processes generally require precisely defined process gas atmospheres (type of gas and partial pressure), particular importance attaches to an adequate vacuum-method separation of the coating stations.

The above-described contrivances and processes are not, as a rule, suited for installations for producing multi-layer systems, since these types of contrivances, because of the great number of sluicing chambers to be disposed behind one another, are enormously space-costly and, moreover, also very expensive because of the required number of pump groups.

Therefore the object of the present invention is to obtain a split sluice that does not display the disadvantages of the known sluices of this type and that on the one hand permits as high as possible a sluicing speed, and on the other hand allows good vacuum-method separation of the coating stations.

In accordance with the invention, this is achieved in that the separating wall, in the region of the two long and parallel wall parts delimiting the split-passage sluice opening, is provided with at least two diametrically opposed and parallel grooves, openings or outflow channels extending in a plane parallel to the plane of the separating wall, whereby the grooves, openings or outflow channels communicate with connectors via which a blocking gas flows in, which out from there fills the entire split space, and from there further flows out into the adjacent chambers connected to vacuum pumps.

Other particulars and features of the invention are described and characterized in more detail in the accompanying patent claims.

The invention permits the most varied of embodiment possibilities; one of these is essentially represented in more detail in the accompanying drawing.

The contrivance consists essentially of:

the two treatment chambers **3, 4** that are separated from each other by the wall **5** and connected to the two vacuum pumps **22, 23**, the cathodes **6, 7** and **8, 9** respectively with the associated targets **10, 11** and **12, 13** respectively disposed in the treatment chambers **3, 4**, the pallets or substrate carriers **24** with the substrates **15, 15'** ... secured thereupon that are movable through the chambers **3, 4** along a rail track **25**, the blocking gas containers **28, 29** on the one hand, and on the other hand the gas pressure lines **26, 27** connected with the gas connectors **20, 21**, the grooves or channels **18, 19**, machined into the wall parts **16, 17**, and the sluices **30, 31** that are to be closed at both ends of the chambers **3, 4**.

For vacuum-method separation of the two chambers **3, 4**, blocking gas flows via lines **26, 27**, the gas connectors **20, 21** and the grooves **18, 19** into the passage **14** essentially delimited by the wall parts **16, 17**, and out from here between the gaps in chambers **3, 4**, formed on the one hand by the substrate carrier **24**, or to be precise, the substrates **15, 15'** ..., and on the other hand by the wall parts, from where the blocking gas is finally suctioned out by the pumps **22, 23** so that it flows almost completely along with the process gases, which can be allowed to enter via lines **32, 33**, and that are needed for the treatment process.

Due to the fact that the blocking gas, at least in the region of the passage **14**, flushes completely around and on all sides of the pallets **24** and the substrates **15, 15'** ... secured thereupon, and also in the phases of the process in which there are no pallets **24** in the passage **14** that the blocking gas completely fills the space enclosed by the four wall parts (of which only two parts **16, 17** are represented in the drawing), it is guaranteed that no process gas at all will seep in and/or spray out from the one chamber **3** into the adjacent chamber. However the assumption here is that the blocking gas flows into the passage **14** at a higher pressure than the process gases flow into chambers **3** and **4**. Finally, it is clear that the blocking gas must be an inert gas.

Reference numbers list

3 Treatment chamber
4 Treatment chamber
5 Separating wall
6 Cathode
7 Cathode
8 Cathode
9 Cathode
10 Target
11 Target
12 Target
13 Target
14 Passage (opening)
15, 15'...Substrate
16 Wall part
17 Wall part
18 Channel, groove, opening
19 Channel, groove, opening
20 Gas connector
21 Gas connector
22 Vacuum pump
23 Vacuum pump
24 Substrate carrier, pallet
25 Rail track
26 Pressure line
27 Pressure line
28 Blocking gas container (tank)
29 Blocking gas container (tank)
30 Sluice
31 Sluice
32 Process gas line
33 Process gas line

Patent Claims

1. Split sluice for bringing in or bringing out substrates from one processing chamber into an adjacent processing chamber (3, 4), or from atmospheric air into a chamber filled with process gas and vice-versa, in particular for a pass-through vacuum coating installation, with a split passage opening (14) for the substrates (15, 15' ...) provided in the wall (5) separating the spaces from one another, **characterized by the fact** that the separating wall (5) in the region of the two long and parallel wall parts (16, 17) delimiting the split passage opening (14), is provided with at least two diametrically opposed and parallel grooves, openings or channels (18, 19), in a plane parallel to the plane of the separating wall (5), that communicate with connectors (20, 21) via which a blocking gas flows in, which out from there fills the entire space delimited by passage (14), and from there further flows out into the adjacent chambers (3, 4) connected to the vacuum pumps (22, 23).

2. Split sluice according to Claim 1, **characterized by the fact** that the blocking gas flowing into the passage (14) via the grooves, openings or channels (18, 19) is an inert gas, and is designed to have an inlet pressure into the passage (14) that is higher than the pressures that the process gases in the chambers (3, 4) display.

(With 1 page of drawings)